REMARKS

Claims 1, 3-19, 21-24, 26-29 and 31-49 are pending in the present application. Claims 1-19, 21-24, 26-29 and 31-39 have been examined and are rejected. In the above amendments, claims 1, 5, 6, 8, 10, 13, 15, 21, 22, 23, 26, 28, 33, 35, 37 and 41 have been amended, and claim 40 has been canceled. Therefore, after entry of the above amendments, claims 1-19, 21-24, 26-29, 31-39 and 41-49 will be pending in this application. Applicant believes that the present application is now in condition for allowance, for which prompt and favorable action is respectfully requested.

Rejection of Claims Under 35 U.S.C. §112, Second Paragraph

Claims 1, 3-7, 9-19, 21-24, 26-29 and 31-49 stand rejected under 35 U.S.C. §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner cited various phrases/limitations in the present claims as being vague and indefinite. Most of these phrases are present in the original claims and are not objected to by the Examiner in the first Office Action dated March 26, 2008 as well as the second Office Action dated December 26, 2008. Applicant does not understand why phrases that are acceptable in the first and second Office Actions have now become vague and indefinite in the current Office Action. Applicant submits that these phrases are clearly described in the claims and the specification. Nevertheless, Applicant will address each offending phrase below.

For claims 1, 7, 10, 13 and 41, the phrase "selected rate" is deemed vague and indefinite. Paragraph [0030] of the present application states "the selected rate for each data packet may indicate the data rate, coding scheme or code rate, modulation scheme, packet size, number of data symbol blocks, and so on, for that packet" (emphasis added). Depending on system implementation, the selected rate may be mapped to one, some, or all of the parameters listed above. Applicant submits that the "selected rate" is clearly described in the present application.

For claim 5, the phrase "receiving a negative acknowledgement (NAK)" is deemed vague and indefinite. This phrase has been replaced with "receiving a negative acknowledgment (NAK) for the data packet from the receiver."

For claim 6, the phrase "if at all" is deemed vague and indefinite. This phrase has been replaced with "if the symbol block is selected for transmission."

For claim 9, the phrase "N_P data packets" is deemed to have insufficient antecedent basis. The term "N_P data packets" is being introduced here, so antecedent basis is not needed.

For claim 15, the phrase "obtaining a block of detected symbols" is deemed vague and indefinite because it is not clear what kind of detector is being used. Claim 15 clearly describes a block of detected symbols and recites "wherein the detected symbol block is an estimate of a data symbol block transmitted from a plurality of transmit antennas" (emphasis added). Furthermore, FIG. 8A of the present application clearly shows a detector 820 being provided with received symbols from different antennas and outputting detected symbols. Paragraph [0067] of the present application states that detector 820 can be implemented with various types of detector such as an MRC detector, a zero-forcing detector, an MMSE detector, etc. Applicant submits that a clear description of "a block of detected symbols" is present in both the claim and specification.

For claims 16, 21, 23, 24, 26, 27 and 28, the phrases "obtaining a block of received symbols" and "detecting the received symbol block to obtain the detected symbol block" are deemed vague and indefinite. As discussed above, independent claim 15 clearly defines the detected symbol block and FIG. 8A clearly shows different types of symbols in the receiver.

For claim 21, the limitation "determining a rate for data transmission based on an average spectral efficiency for the plurality of transmit antennas at the transmitter" is deemed vague and indefinite since it has no relation with the previous limitations of claim 21. This phrase has been moved up to be the first element of claim 21 and is related to the second element of claim 21.

For claim 22, the limitation "back-off factor" is deemed vague and indefinite. The phrase 'back-off factor" is clearly described in paragraph [00102] of the present application. Nevertheless, this phrase has been deleted from claim 22.

For claim 22, the phrase "selecting a rate" is deemed vague and indefinite. As discussed above for claim 1, the phrase "rate" is clearly described in paragraph [0030].

For claim 28, the phrase "receiving a block of received symbols" is deemed vague and indefinite. As shown in FIG. 8A, the received symbols are clearly shown as being provided by receiver 154 to detector 820.

For claims 28, 33, 35 and 37, the phrase "a last iteration" is deemed vague and indefinite. This phrase has been changed to "a final iteration among the plurality of iterations."

For claims 32 and 37, the phrase "where N is one or greater" is deemed vague and indefinite because it can create infinite number of possibilities. Applicant submits that reciting "N iterations, ... where N is one or greater" is equivalent to reciting "at least one iteration," which would not be considered as vague and indefinite.

For claim 33, the phrase "a detector operative to detect all received symbol blocks received for the data packet to obtain detected symbol blocks, one detected symbol block for each received symbol block" is deemed vague and indefinite. As discussed above, the detector is clearly shown in FIG. 8A and fully described in paragraph [0067].

For claim 39, the phrase "transmitting the data packet" is deemed to have insufficient antecedent basis. The antecedent basis for "the data packet" is given in claim 1, which recites "processing a data packet."

For claim 40, the phrase "different redundancy" is deemed to have insufficient antecedent basis. This claim has been canceled.

Accordingly, the §112, second paragraph, rejection of claims 1, 3-7, 9-19, 21-24, 26-29 and 31-49 should be withdrawn.

Rejection of Claims 1, 3, 5-14 and 41 Under 35 U.S.C. §103(a)

Claims 1, 3, 5-14 and 41 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Piiranien (US 7,031,419) in view of Applicant Admitted Prior Art (AAPA).

Claim 1 of the present application, as amended, recites:

> "A method of performing incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:
>
> obtaining a selected rate for data transmission on a MIMO channel between a plurality of transmit antennas at a transmitter and a plurality of receive antennas at a receiver;
>
> processing a data packet in accordance with the selected rate to obtain a plurality of symbol blocks, each symbol block including different coded information for the data packet;
>
> transmitting a first symbol block from the plurality of transmit antennas at the transmitter to the plurality of receive antennas at the receiver, wherein the first symbol block is one of the plurality of symbol blocks; and

transmitting remaining ones of the plurality of symbol blocks, one symbol block at a time, until the data packet is recovered correctly by the receiver or all of the plurality of symbol blocks are transmitted."

Applicant submits that claim 1 is patentable over Piiranien in view of AAPA for at least the following reasons.

First, the combination of Piiranien and AAPA does not disclose "obtaining a selected rate for data transmission on a MIMO channel," and "processing a data packet in accordance with the selected rate to obtain a plurality of symbol blocks" (emphasis added), as recited in claim 1. The Examiner states that Piiranien does not expressly teach obtaining a selected rate for data transmission on a MIMO channel. The Examiner then states that paragraph [0006] of AAPA teaches this limitation. Paragraph [0006] states "the transmitter typically processes and transmits each data packet at the rate selected for that data packet." Paragraph [0006] further states "the transmitter may retransmit each data packet decoded in error by the receiver, in its entirety, upon receiving a NAK from the receiver for the packet." Thus, each data packet is processed to generate a single symbol block, which is transmitted in its entirely if the data packet is decoded in error. AAPA does not describe processing a data packet in accordance with the selected rate to obtain a plurality of symbol blocks, which can be transmitted one symbol block at a time, as recited in claim 1.

Second, the combination of Piiranien and AAPA does not disclose "each symbol block including different coded information for the data packet" (emphasis added), as recited in claim 1. This feature is disclosed in paragraph [0046] of the present application. AAPA does not describe generating a plurality of symbol blocks and hence does not describe each symbol block including different coded information. Piiranien describes "retransmitting the same blocks in a predetermined format." (See the Abstract, lines 8-9, and column 2, lines 38-40 of Piiranien.) Piiranien states "the symbols are first transmitted as such, i.e. s1 and s2 from antennas of their own. ... If reception fails, retransmission will be carried out. Now the same symbols are transmitted as -s2* and s1*" (See column 10, lines 22-27.) Piiranien thus describes retransmitting the same symbols s1 and s2 (with complex conjugate * and negative sign) to achieve space-time block coding/transmit diversity. The space-time block coding in Piiranien requires retransmission of the same symbols with a specific format. Furthermore, the space-time block coding in Piiranien utilizes exactly two transmit antennas. In contrast,

the plurality of data symbol blocks in claim 1 comprise different redundancy/coded information, which may improve performance over the space-time block coding in Piiranien. Furthermore, the plurality of data symbol blocks in claim 1 can be transmitted from any number of transmit antennas greater than one, and is not restricted to two antennas.

For at least the above reasons, Applicant submits that claim 1 is patentable over Piiranien in view of AAPA. Claims 5-7 and 9 are dependent on claim 1 and are patentable for at least the reasons noted above for claim 1. These dependent claims may recite additional features not disclosed nor suggested by Piiranien and AAPA.

Independent claims 8, 10, 13 and 41 have each been amended to recite the features noted above for claim 1. Claims 11 and 12 are dependent on claim 10, and claim 14 is dependent on claim 13. Claims 8-14 and 41 are patentable for at least the reasons noted for claim 1.

Accordingly, the §103(a) rejection of claims 1, 3, 5-14 and 41 should be withdrawn.

Rejection of Claims 15-19, 22-24, 26-29, 31-40 and 49 Under 35 U.S.C. §102(e)

Claims 15-19, 22-24, 26-29, 31-40 and 49 stand rejected under 35 U.S.C. §102(e) as being anticipated by Tarokh (US 2004/0057530).

Claim 15 of the present application, as amended, recites:

> "A method of receiving an incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:
>
> obtaining a block of detected symbols for a data packet, wherein the detected symbol block is an estimate of a data symbol block transmitted from a plurality of transmit antennas at a transmitter and received by a plurality of receive antennas at a receiver, and wherein the data symbol block is one of a plurality of data symbol blocks generated for the data packet, each data symbol block including different coded information for the data packet;
>
> decoding all detected symbol blocks obtained for the data packet to provide a decoded packet;
>
> determining whether the decoded packet is correct or in error; and
>
> repeating the obtaining, decoding, and determining for another one of the plurality of data symbol blocks if the decoded packet is in error."

Applicant submits that claim 15 is not anticipated by Tarokh for at least the following reasons.

First, Tarokh does not disclose "obtaining a block of detected symbols for a data packet, wherein the detected symbol block is an estimate of a data symbol block ..., and wherein the data symbol block is one of a plurality of data symbol blocks generated for the data packet, each data symbol block including different coded information for the data packet" (emphasis added), as recited in claim 15. Rather, Tarokh describes retransmitting the same symbols, which have been decoded in error, in a redundant fashion. (See paragraph [0067].) This is clearly shown in FIGS. 6-11 of Tarokh, which show symbols s_1 and s_2 being decoded in error, and the same symbols s_1 and s_2 being retransmitted at a later time. Tarokh also describes retransmitting the same symbols s_1 and s_2 with complex conjugate * and negative sign to achieve space-time block coding/transmit diversity. The space-time block coding in Tarokh (similar to that in Piiranien) requires retransmission of the same symbols with a specific format. Furthermore, the space-time block coding in Tarokh utilizes exactly two transmit antennas. In contrast, the plurality of data symbol blocks in claim 15 comprise different redundancy/coded information, which may improve performance over the space-time block coding in Tarokh. Furthermore, the plurality of data symbol blocks in claim 15 can be transmitted from any number of transmit antennas greater than one, and is not restricted to two antennas.

Second, Tarokh appears to teach away from sending redundant information. Paragraph [0024] of Tarokh states:

> "However, for transmission using multiple antennas, incremental redundancy schemes are not known. This is partially due to the fact that in a space-time channel, signals transmitted from different antennas superpose, and this makes it difficult to improve the transmitted signals with increasing redundancy. In this light, there is a need for a way to construct space-time codes to facilitate incremental redundancy in a spatially diverse communication environment."

Tarokh thus teaches away from using redundant information (e.g., different coded information) to improve performance. Instead, Tarokh teaches sending the same symbols using space-time codes to improve performance.

For at least the above reasons, Applicant submits that claim 15 is not anticipated by Tarokh. Claims 16-19 are dependent on claim 15 and are not anticipated by Tarokh for at least the reasons noted for claim 15. These dependent claims may recite additional features not disclosed nor suggested by Tarokh.

Independent claims 21, 23, 26 and 49 each recites the feature noted above for claim 15. Claim 24 is dependent on claim 23, and claim 27 is dependent on claim 26. Claims 21, 23, 24, 26, 27 and 49 are not anticipated by Tarokh for at least the reasons noted above for claim 15.

Claim 28 of the present application, as amended, recites:

> "A method of receiving an incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:
>
> receiving a block of received symbols for a data packet, wherein the received symbol block is for a data symbol block transmitted from a plurality of transmit antennas at a transmitter and received by a plurality of receive antennas at a receiver, and wherein the data symbol block is one of a plurality of data symbol blocks generated for the data packet;
>
> detecting all received symbol blocks received for the data packet to obtain detected symbol blocks, one detected symbol block for each received symbol block;
>
> decoding the detected symbol blocks for the data packet to obtain decoder feedback information;
>
> performing the detecting and decoding for a plurality of iterations, wherein the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration; and
>
> generating a decoded packet based on an output from the decoding for a last iteration among the plurality of iterations."

Applicant submits that claim 28 is not anticipated by Tarokh for at least the following reason. Tarokh does not disclose "performing the detecting and decoding for a plurality of iterations, wherein the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration" (emphasis added), as recited in claim 28. The Examiner indicates that this feature of claim 28 is disclosed by Tarokh in paragraph

[0083]. This paragraph states "note that equation 13 provides zero-forcing results for equation 12. Other, more sophisticated algorithms, such as iterative MMSE and MLD, can be used to further improve the system performance." Tarokh mentions "iterative" only once and also mentions "MMSE" only once. Tarokh does not describe MMSE and also does not describe how iterative detection can be performed. Tarokh describes MLD in equations (4) through (8) and shows MLD operating on the received symbols $r_{1,m}$ and $r_{2,m}$. Although not described by Tarokh, MMSE also operates on the received symbols and provides detected symbols. Thus, it is not clear how MLD can be combined with MMSE since both operate on the received symbols. A reasonable interpretation of Tarokh may be "iterative MMSE" being one algorithm and "MLD" being another algorithm. Tarokh does not clearly describe iterative MMSE and MLD being one algorithm and further does not provide any teaching on how this algorithm can be performed, thus making it non-enabling.

In contrast, claim 28 clearly recites a two-step process that includes (i) detecting received symbols to obtain detected symbols and (ii) decoding the detected symbol blocks to obtain decoder feedback information, which is used by the detecting in a subsequent iteration. The "detecting" and "decoding" are thus performed on different symbols, and the output of one step is used as an input to the other step.

For at least the above reason, Applicant submits that claim 28 is not anticipated by Tarokh. Claims 29, 31 and 32 are dependent on claim 28 and are not anticipated by Tarokh for at least the reason noted for claim 28. These dependent claims may recite additional features not disclosed nor suggested by Tarokh.

Independent claims 33 and 35 each recites the features noted above for claim 28. Claim 34 is dependent on claim 33, and claim 36 is dependent on claim 35. Claims 33-36 are not anticipated by Tarokh for at least the reason noted above for claim 28.

Claim 37 of the present application, as amended, recites:

> "A method of receiving a data transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:
>
> detecting received symbols for a data packet to obtain detected symbols;
>
> decoding the detected symbols to obtain decoder feedback information;

performing the detecting and decoding for a plurality of iterations, wherein the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration, wherein the detecting is performed based on a minimum mean square error (MMSE) detector for first N iterations, where N is one or greater, and based on a maximal ratio combining (MRC) detector or a linear zero-forcing (ZF) detector for remaining ones of the plurality of iterations; and

generating a decoded packet based on an output from the decoding for a last iteration among the plurality of iterations."

Applicant submits that claim 37 is not anticipated by Tarokh for at least the following reasons.

First, Tarokh does not disclose "performing the detecting and decoding for a plurality of iterations, wherein the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration" (emphasis added), as recited in claim 37. The Examiner indicates that this feature of claim 37 is disclosed by Tarokh in paragraph [0083]. As discussed above for claim 28, Tarokh does not clearly describe iterative MMSE and MLD being one algorithm and further does not provide any teaching on how this algorithm can be performed, thus making it non-enabling.

Second, Tarokh does not disclose "wherein the detecting is performed based on a minimum mean square error (MMSE) detector for first N iterations, where N is one or greater, and based on a maximal ratio combining (MRC) detector or a linear zero-forcing (ZF) detector for remaining ones of the plurality of iterations" (emphasis added), as recited in claim 37. The Examiner indicates that this feature of claim 37 is disclosed by Tarokh in paragraph [0083]. This paragraph describes using one algorithm, which may be zero-forcing, iterative MMSE, or MLD. This paragraph does not describe using one algorithm for N iterations and then using another algorithm for the remaining iterations, as recited in claim 37.

For at least the above reasons, Applicant submits that claim 37 is not anticipated by Tarokh. Claim 38 is dependent on claim 37 and is not anticipated for at least the reasons noted for claim 37.

Accordingly, the §102(e) rejection of claims 15-19, 22-24, 26-29, 31-40 and 49 should be withdrawn.

Rejection of Claims 21 and 42-48 Under 35 U.S.C. §103(a)

Claim 21 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Tarokh in view of Alouini (US 6,304,593). The Examiner states that Tarokh describes all of the features of claim 21 except for "determining a rate for data transmission based on an average spectral efficiency for a plurality of transmit antennas at a transmitter." The Examiner then states that Alouini describes this feature of claim 21. As discussed above, Tarokh does not disclose "each data symbol block including different coded information." Hence, Tarokh is an insufficient basis for the §103(a) rejection of claim 21. Alouini does not address the deficiencies of Tarokh.

Claims 42-48 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Tarokh in view of Haustein *et al* (US 7,366,520). Claims 42-48 are dependent on claims 15, 23, 26, 28, 33, 35 and 37, respectively. Tarokh does not disclose all of the elements of base claims 15, 23, 26, 28, 33, 35 and 37, as discussed above. Hence, Tarokh is an insufficient basis for the §103(a) rejection of dependent claims 42-48. Haustein does not address the deficiencies of Tarokh.

Accordingly, the §103(a) rejection of claims 21 and 42-48 should be withdrawn.

CONCLUSION

In light of the amendments contained herein, Applicant submits that the application is in condition for allowance, for which early action is requested.

Please charge the requisite fee to Deposit Account No. 17-0026. Please charge any fees or overpayments that may be due with this response to Deposit Account No. 17-0026.

Respectfully submitted,

Dated: October 30, 2009

By: _____
Peng Zhu, Registration No. 48,063
(858) 658-2389

QUALCOMM Incorporated
Attn: Patent Department
5775 Morehouse Drive
San Diego, California 92121-1714
Telephone: (858) 658-2426
Facsimile: (858) 658-2502